Engineering Notebook

MakeX Challenge 2019 - courageous Traveler

KMIDS Thailand

"NEVER STOP TO LEARN AND IMPROVE"

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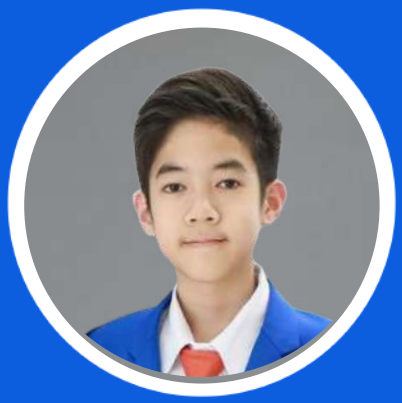
Team Member

Tonnum

- Assistance with the manual stage program
- Operator (Backup player)



Mee-Pooh

- Engineer (Hardware)
- Programmer (Manual stage)
- Manager of Publicity (Engineering notebook)
- Operator (Real player)
- Observer (Backup player)

Joe

- Programmer (Manual stage)
- Typist (Engineering notebook)
- Observer (Real player)

Mentor

Nu

- Mentor 1

Park

- Mentor 2

Design Inspirations

Mentors

Not all projects go smoothly without any guidance, while working we will surely face problems. Thankfully, we have many helpful mentors that show us the solutions to each problem. They also help us find better ideas or design factor of the robot

Internet

The internet, one of the biggest factors of the world currently with almost half the world's population (48.2%) using the internet daily. We also got some solutions and designs from surfing around in the internet for ideas. We also did some research wheather which design for the robot would be more effective for this current mission and competition.

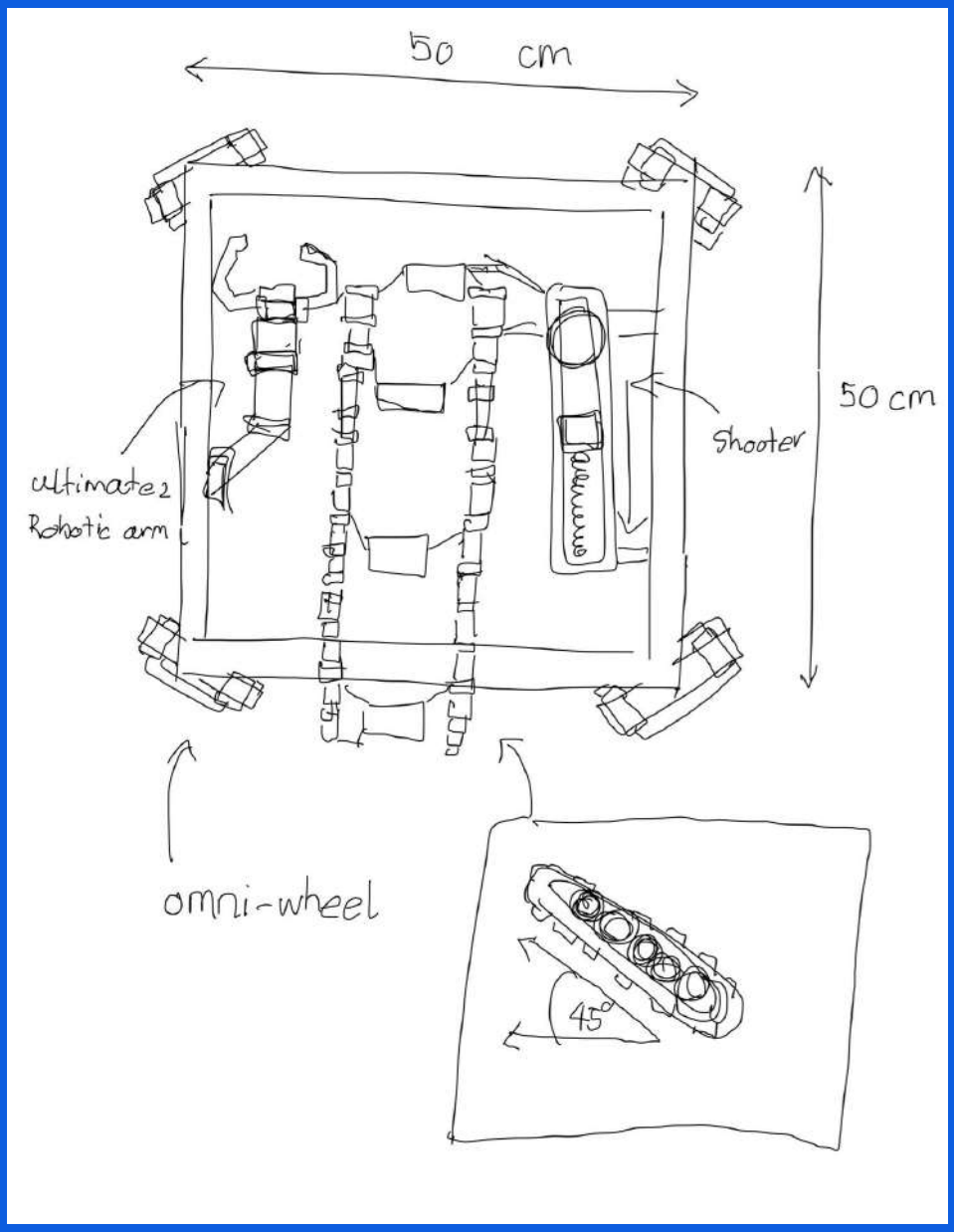
STEM

STEM class during school

Although we are not the best at programming, we do get some of our skills from the STEM (Science Technology Engineering Mathematics) class during school time. This helps us in the order and logic in programming.

Sketch

First Sketch (11th June 2019)



Hardware Principles

- We should split the project into several parts, it keep the work organized.
- In order to fix the problem we should know what the root cause is.
- To find out the root cause, we need to check each variable factor one by one.
- We have to balance the robot's weight equally each wheel.
- We should set the right angle for the shooting mechanism.

Software Principles

- We should think of the solution and how the robot must move before writing the program.
- We should measure the values for the sensors first before writing the program.
- If necessary, we should make our own values for the rgb sensor to be more accurate.
- We should split the program into parts so it will be easier to identify the mistakes.
- The program should not fail without anything changing the environment factors.

Daily Report

11th June 2019

Day 1 - Draw overall sketch of the robot, familiarized to the makeblock set, and made the drive system of our robot using the omni wheel which at first was holonomics drive system

50%	Drive System
1%	Ball Collecting System
1%	Ball feeding machine
1%	Ball shooting machine

13th June 2019

Day 2 - Started making the ball collecting machine using one conveyer belt with two gears attached at the top and bottom of the conveyor belt however the result was unsuccessful because the balls were stuck with the gear.

50%	Drive System
20%	Ball Collecting System
1%	Ball feeding machine
1%	Ball shooting machine

18th June 2019

Day 3 - Tried to fix the problem of the balls that are stuck in the gear by making a barrier to localize the balls, made it travel on its own route but the result was still unsuccessful - Tried making the ball a shooting machine using spring mechanism to strum the ball without adding gears, but it remained unfinished.

50%	Drive System
40%	Ball Collecting System
1%	Ball feeding machine
21%	Ball shooting machine

19th June 2019

Day 4 - Continued fixing the problem that balls were stuck in the gear by attaching another gear at the middle of the conveyor belt and increasing the size of the barrier to localize the ball and make all the balls fall on the same position, the end result was successful. The single conveyor belt ball collecting machine was done. - Addied gear into the ball shooting machine, however it was still strumming the ball too weakly.

50%	Drive System
70%	Ball Collecting System
1%	Ball feeding machine
20%	Ball shooting machine

20th June 2019

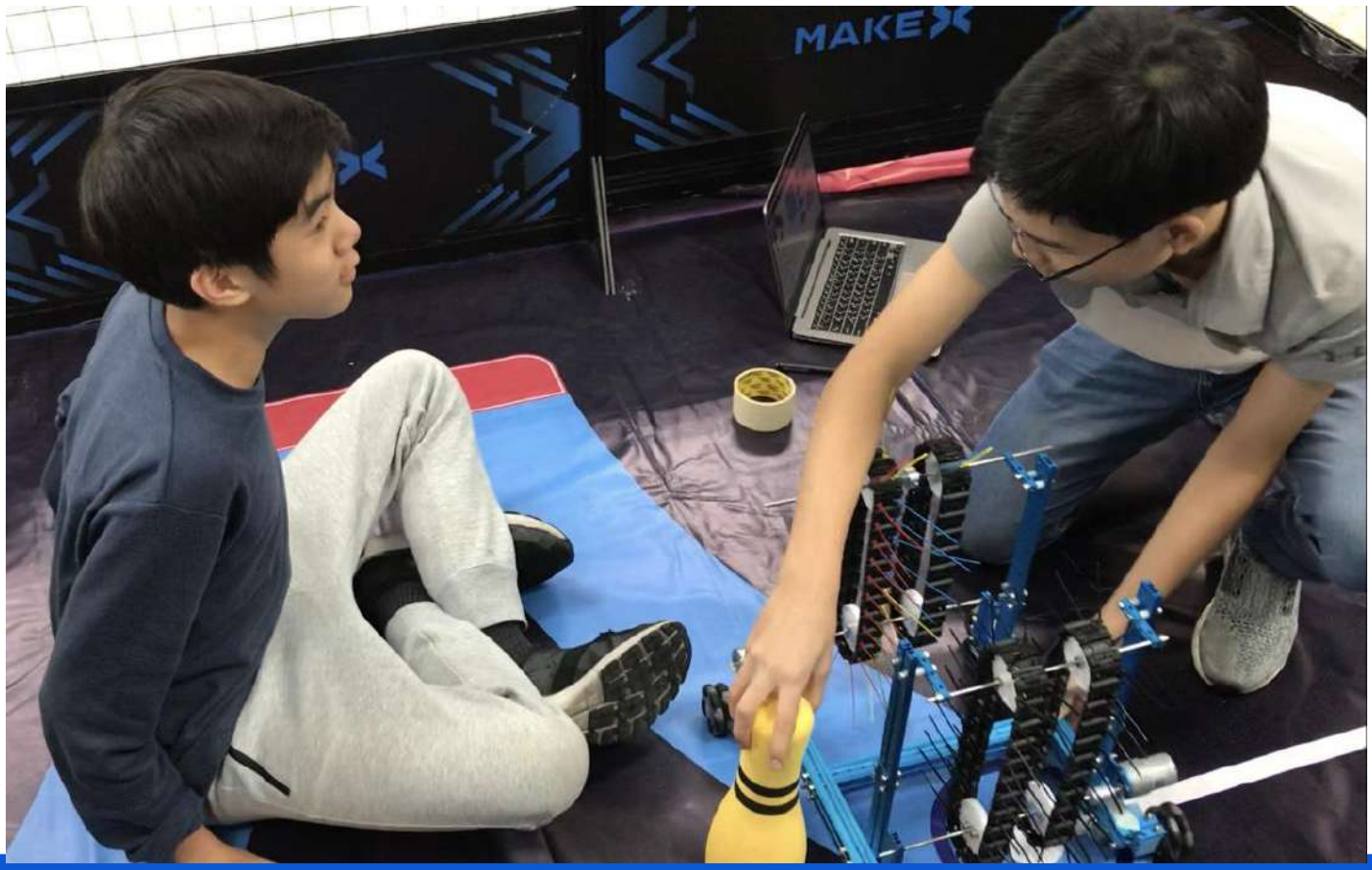
Day 5 - Made the ball shooting machine strum harder by adding more gears and changing the motor from 50 rpm to 200 rpm, this resulted in the ball shooting machine strumming the ball harder but still not hard enough to make it shoot precisely. - Designed and made the pin gripper for the automatic stage using the smart servo motor, the end result was successful and was able to grab and move the pin efficiently.

50%	Drive System
70%	Ball Collecting System
1%	Ball feeding machine
20%	Ball shooting machine

2nd July 2019

Day 6 - We tried making new ball shooting machine. We also disassembled everything and started designing a new drive system and ball collecting machine. We built the new drive system. We also built a new ball collecting machine using four conveyor belts (two on each side) instead of one.

90%	Drive System
90%	Ball Collecting System
1%	Ball feeding machine
20%	Ball shooting machine



4th July 2019

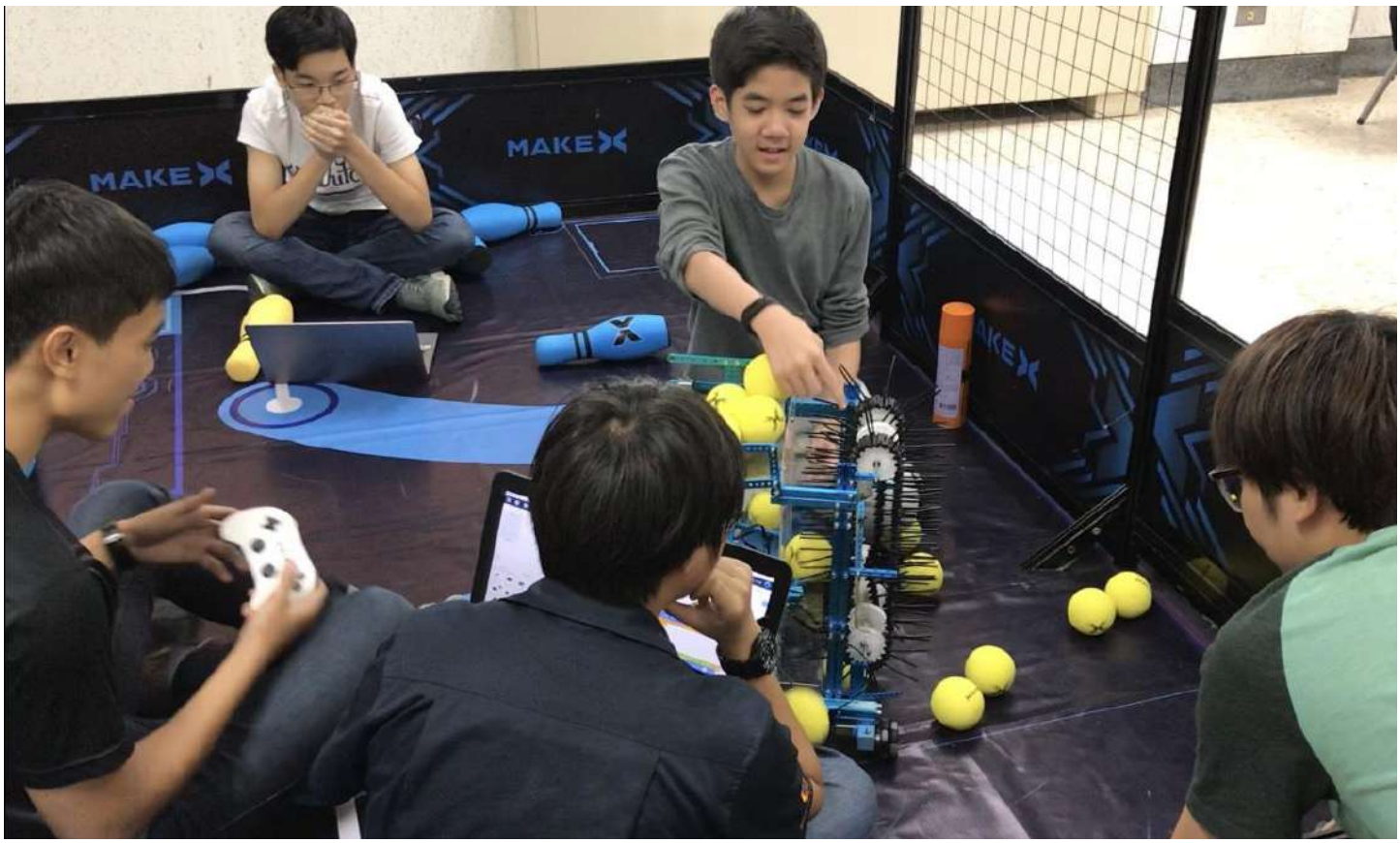
Day 7 - We found out that there wasn't enough space for the ball storing tank so we remove one side of the ball collecting machine and start making the ball storing tank. We also re-built another side of the ball collecting machine, then we made a barrier that is made out of acrylic and attached it to the robot.

90%	Drive System
90%	Ball Collecting System
1%	Ball feeding machine
20%	Ball shooting machine

5th July 2019

Day 8 - We attached the ball storing tank to the robot. We attached it with a slight tilt so that the ball can gather in the same position and flow down to the ball shooting machine. But the problem was that it was stuck so we added the ball feeding machine to the robot using the wheel that is attached to the servo motor for sorting the ball and making it flew down to the ball shooting machine.

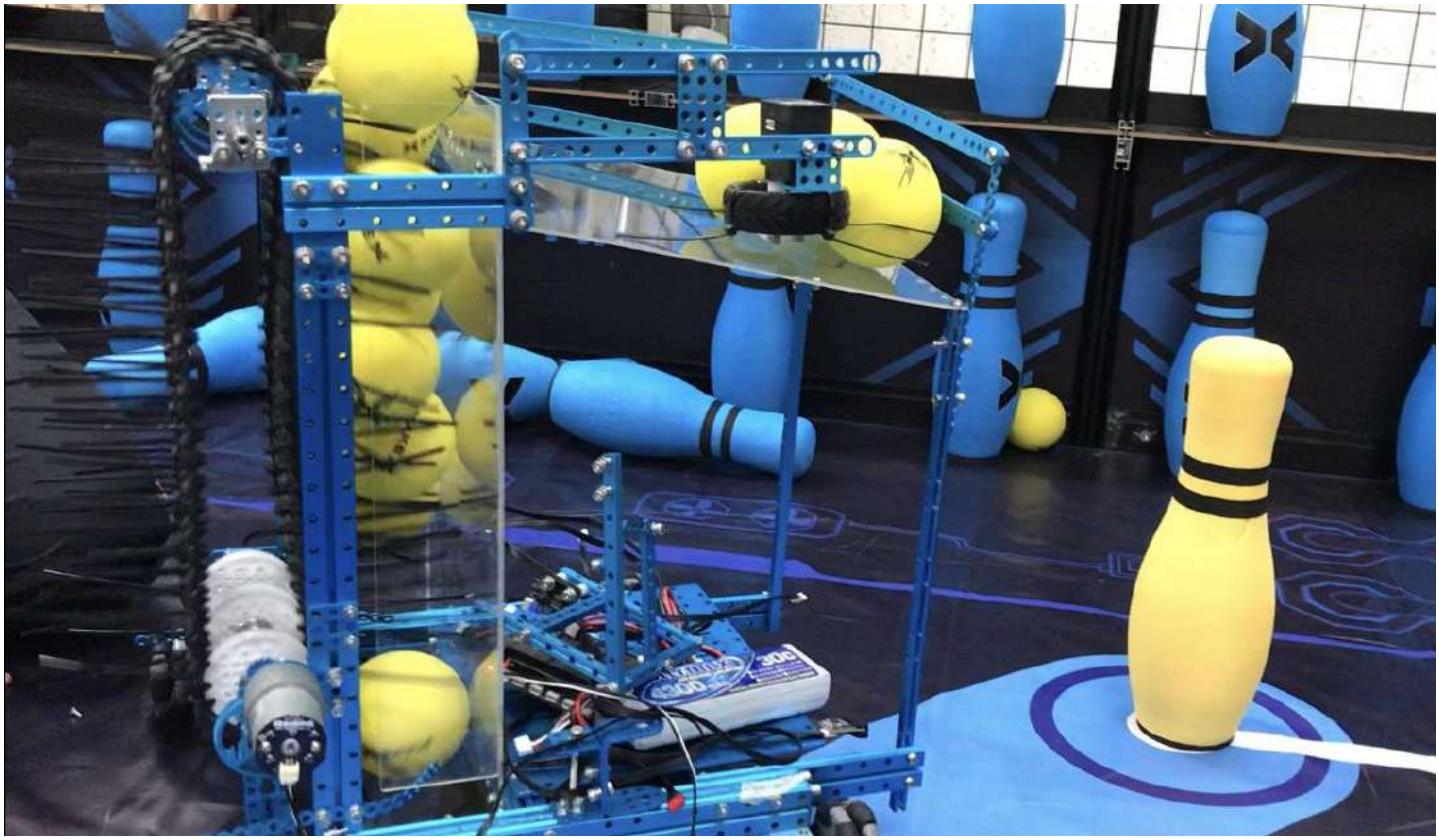
90%	Drive System
90%	Ball Collecting System
20%	Ball feeding machine
20%	Ball shooting machine



10th July 2019

Day 9 - We made the pin gripper for the automatic stage, and add more barrier to the ball storing tank. We also started planning for the automatic stage and manual stage program.

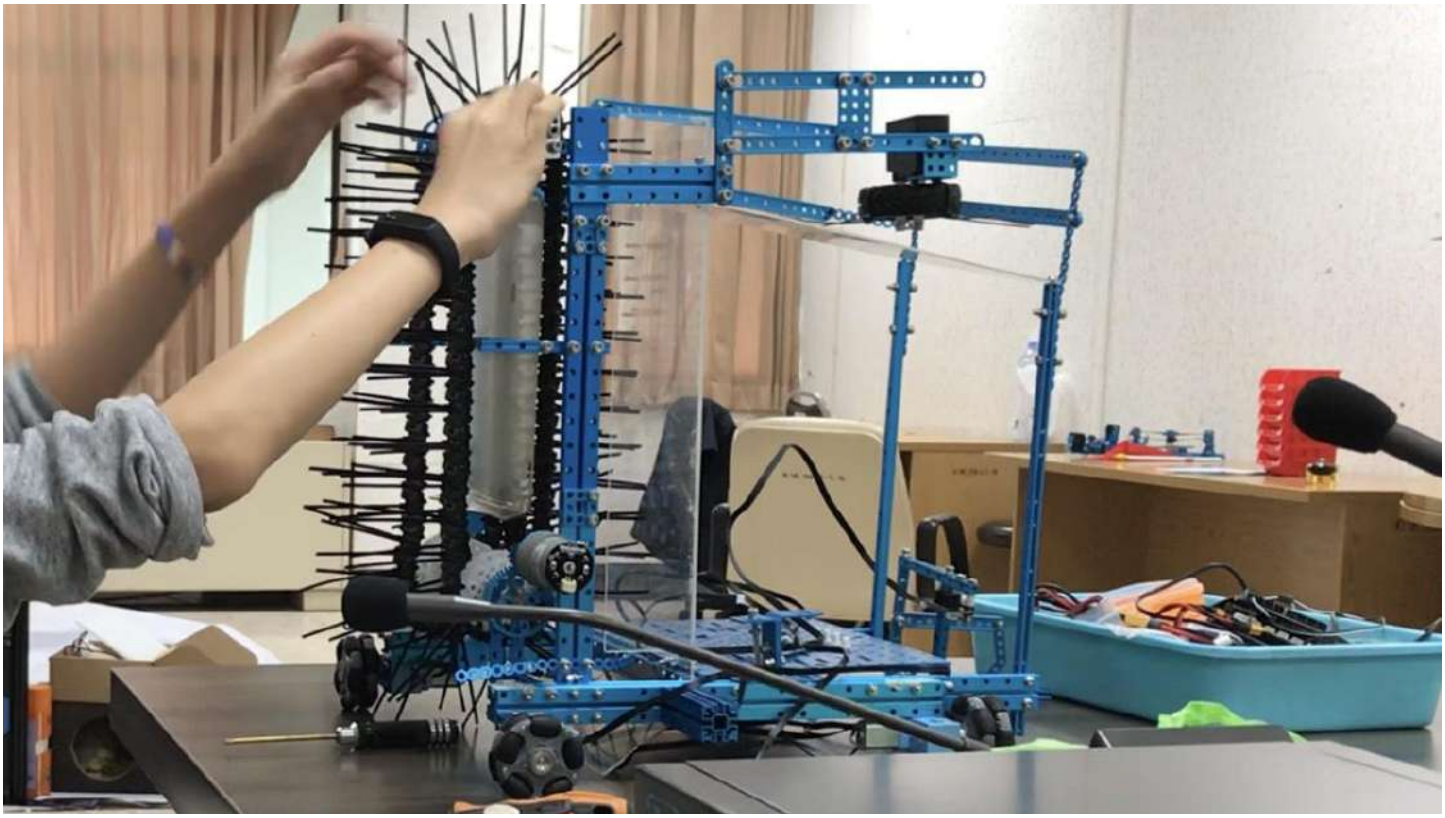
90%	Drive System
90%	Ball Collecting System
20%	Ball feeding machine
20%	Ball shooting machine



24th July 2019

Day 10 - We continued to make the ball shooting machine and the ball collecting machine. We made the flag gripper for the modification stage, and it was successful.

100%	Drive System
100%	Ball Collecting System
60%	Ball feeding machine
20%	Ball shooting machine



26th July 2019

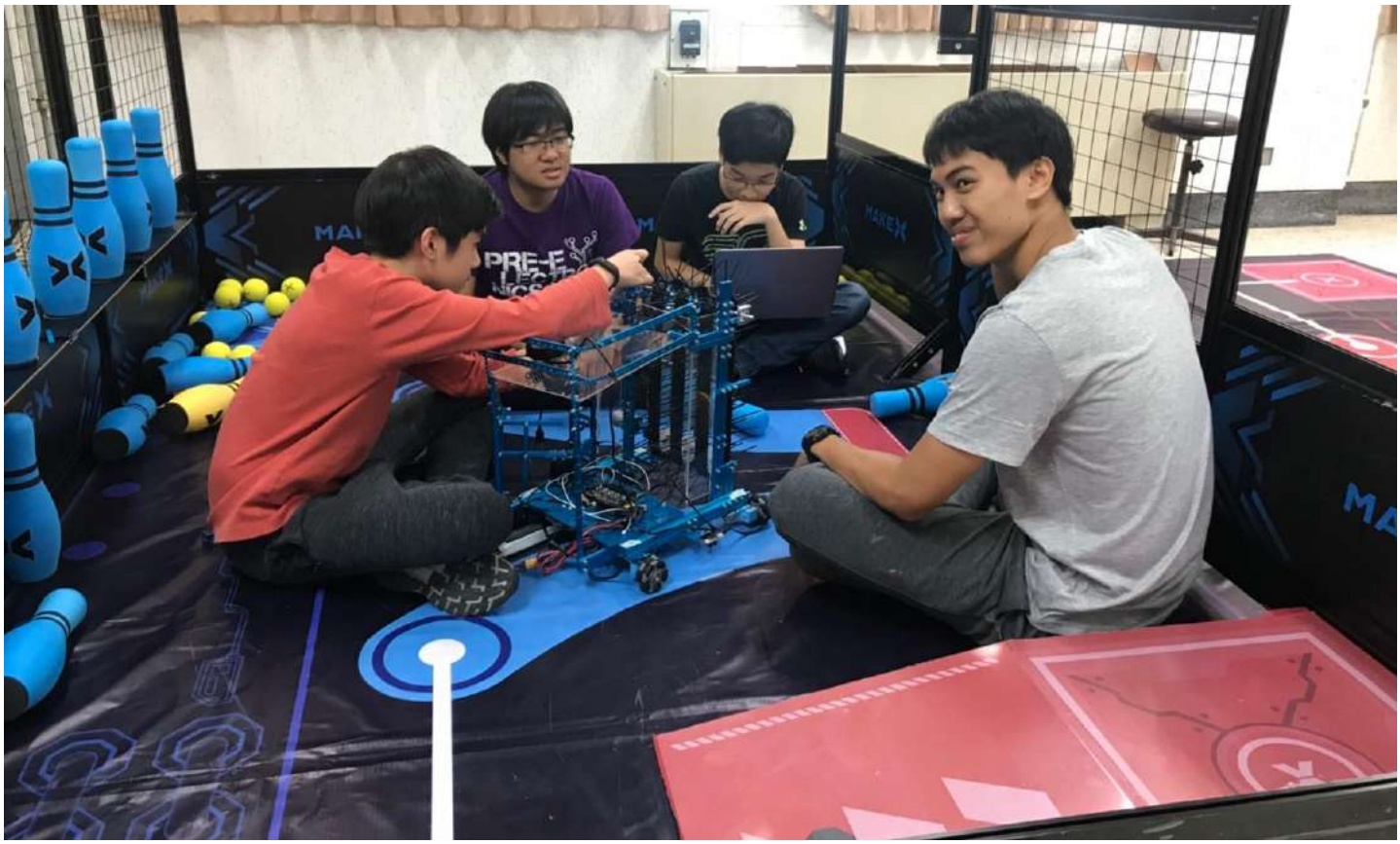
Day 11 - We continued to fix the problem on the ball collecting machine and the ball shooting machine. We made a gearbox which gave the machine more force, we hoped that the problem was fixed, but it spinned too slow and the problem occasionally occurred.

100%	Drive System
100%	Ball Collecting System
75%	Ball feeding machine
20%	Ball shooting machine

29th July 2019

Day 12 - The ball collecting machine could finally collect 6 or more balls at a time after we changed the gear ratio. We finished the paper interview, and tested the ball shooting machine that we changed by using a new gear ratio and roller blade wheels, it could shoot but not fast enough.

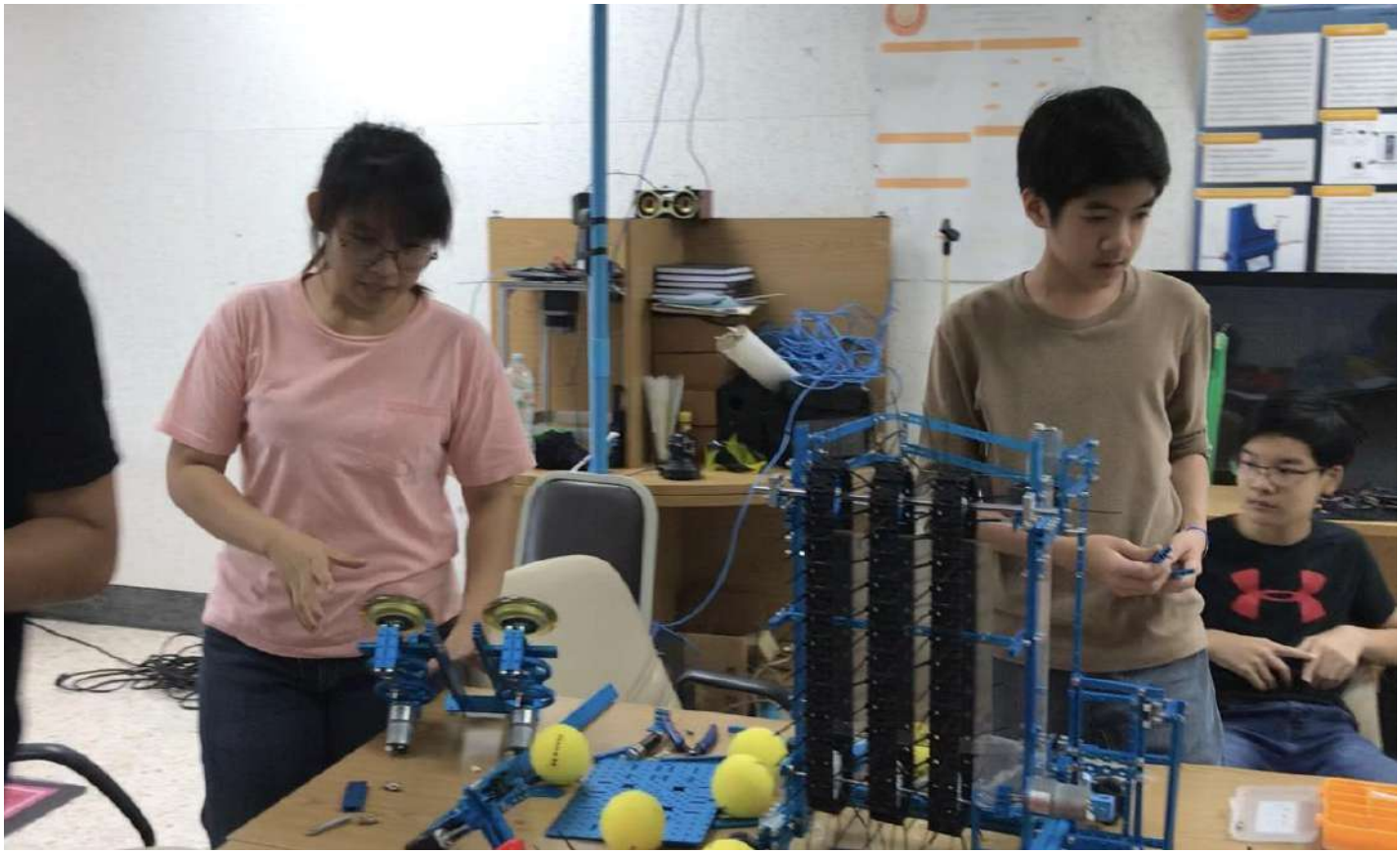
100%	Drive System
100%	Ball Collecting System
75%	Ball feeding machine
20%	Ball shooting machine



30th July 2019

Day 13 - We tried out the automatic stage program and found a place to put the ball shooting machine. We also made the new pin gripper so that the robot won't exceed 50cm.

100%	Drive System
100%	Ball Collecting System
75%	Ball feeding machine
40%	Ball shooting machine



31st July 2019

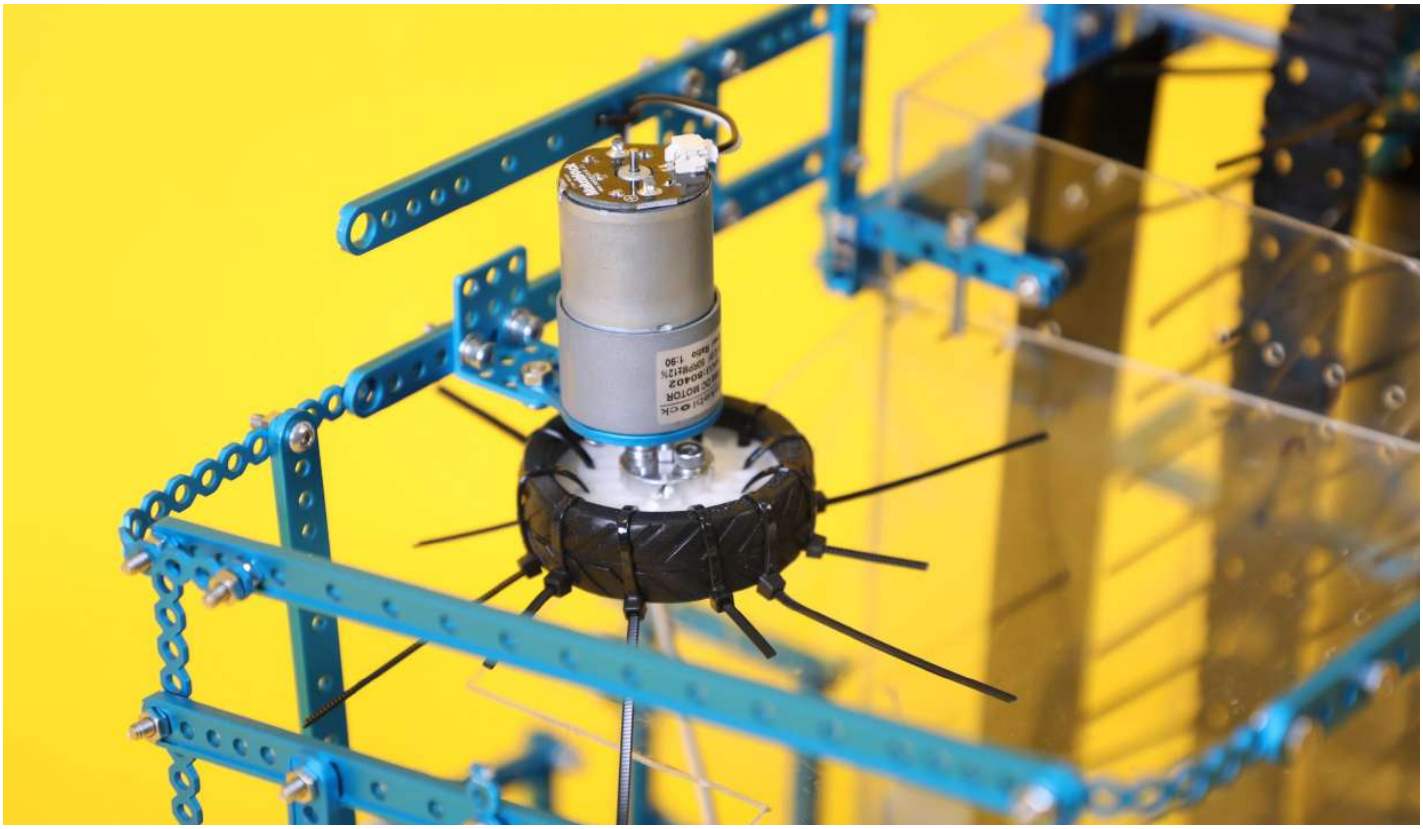
Day 14 - We started making the triggers for the ball shooting machine. At first with used the wheel that attached with many cable ties as a trigger but it didn't work efficiently. We changed it to a pulley but it still didn't work so we changed it to a spinning stick that will push the ball to the shooting machine, and it worked successfully.

100%	Drive System
100%	Ball Collecting System
75%	Ball feeding machine
40%	Ball shooting machine

2nd August 2019

Day 16 - We started program the automatic stage and manual stage program. We made the net and attach it with the flag gripper, they both work out well.

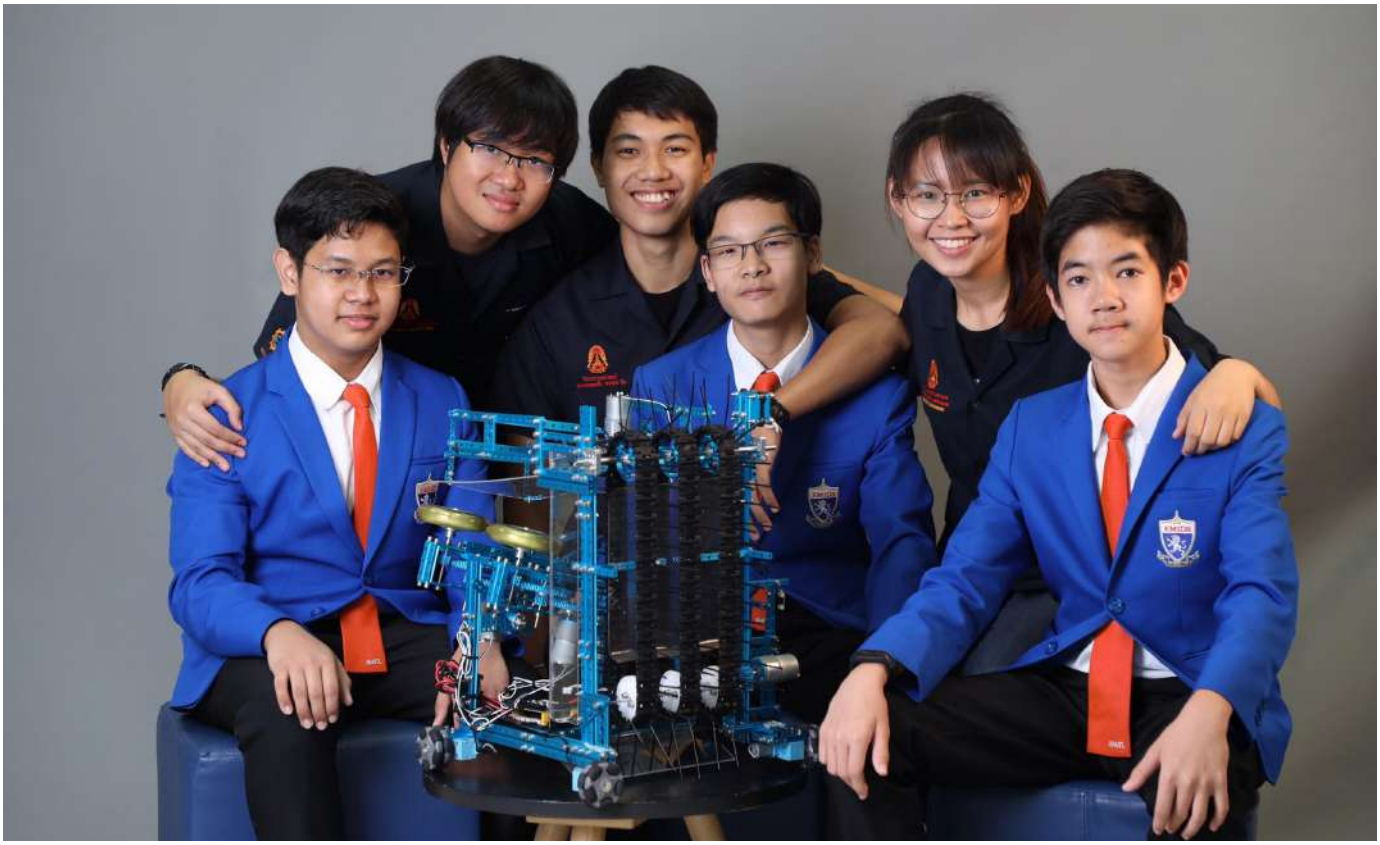
100%	Drive System
100%	Ball Collecting System
75%	Ball feeding machine
40%	Ball shooting machine



5th August 2019

Day 17 - We re-built the ball feeding machine because the ball usually stuck with the ball feeding machine and caused the program error. We started program the auto-reload function.

100%	Drive System
100%	Ball Collecting System
100%	Ball feeding machine
60%	Ball shooting machine



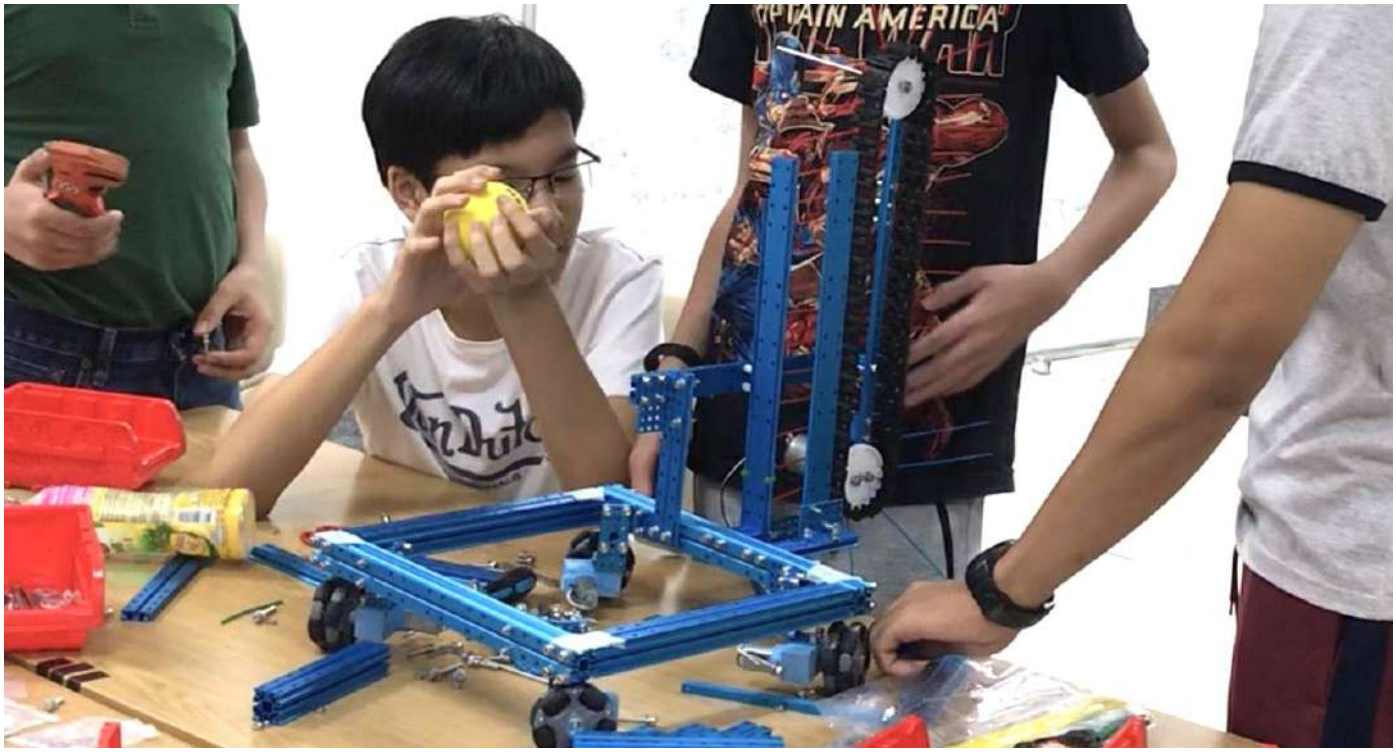
6th - 7th August 2019

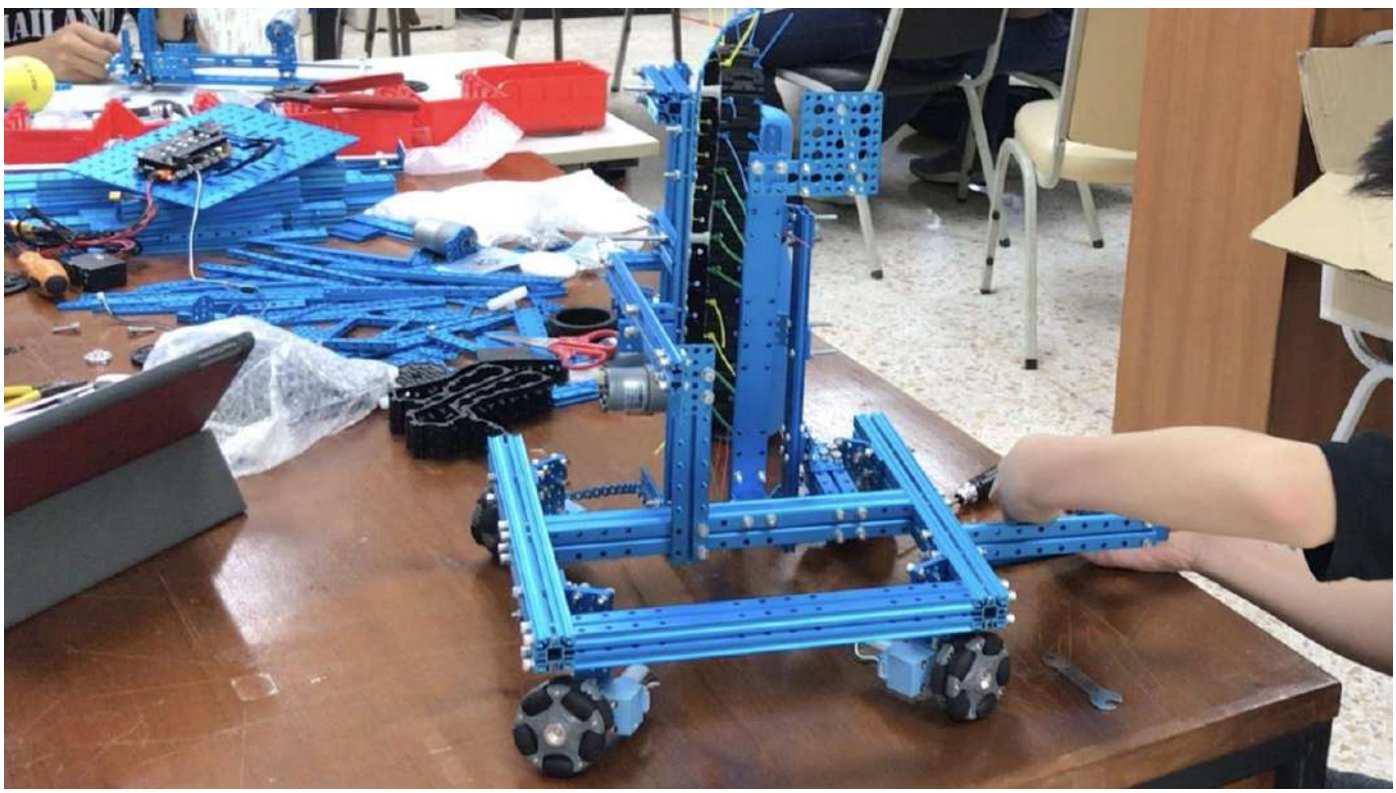
Day 18-19 - We rearranged the wires and the nova pi board and made the shield to protect them we also tested out the manual and automatic stage program, re-programed it until it was successfully done.

100%	Drive System
100%	Ball Collecting System
100%	Ball feeding machine
100%	Ball shooting machine

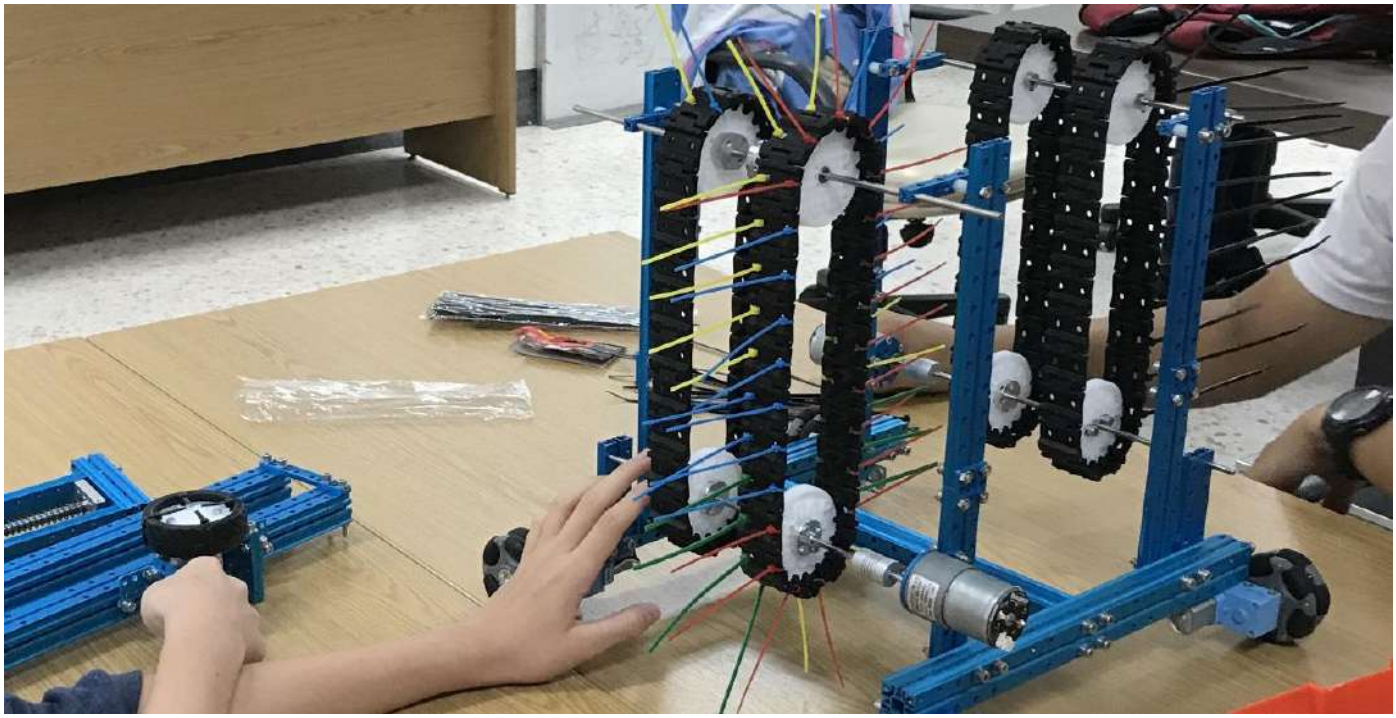
Step-by-Step Production

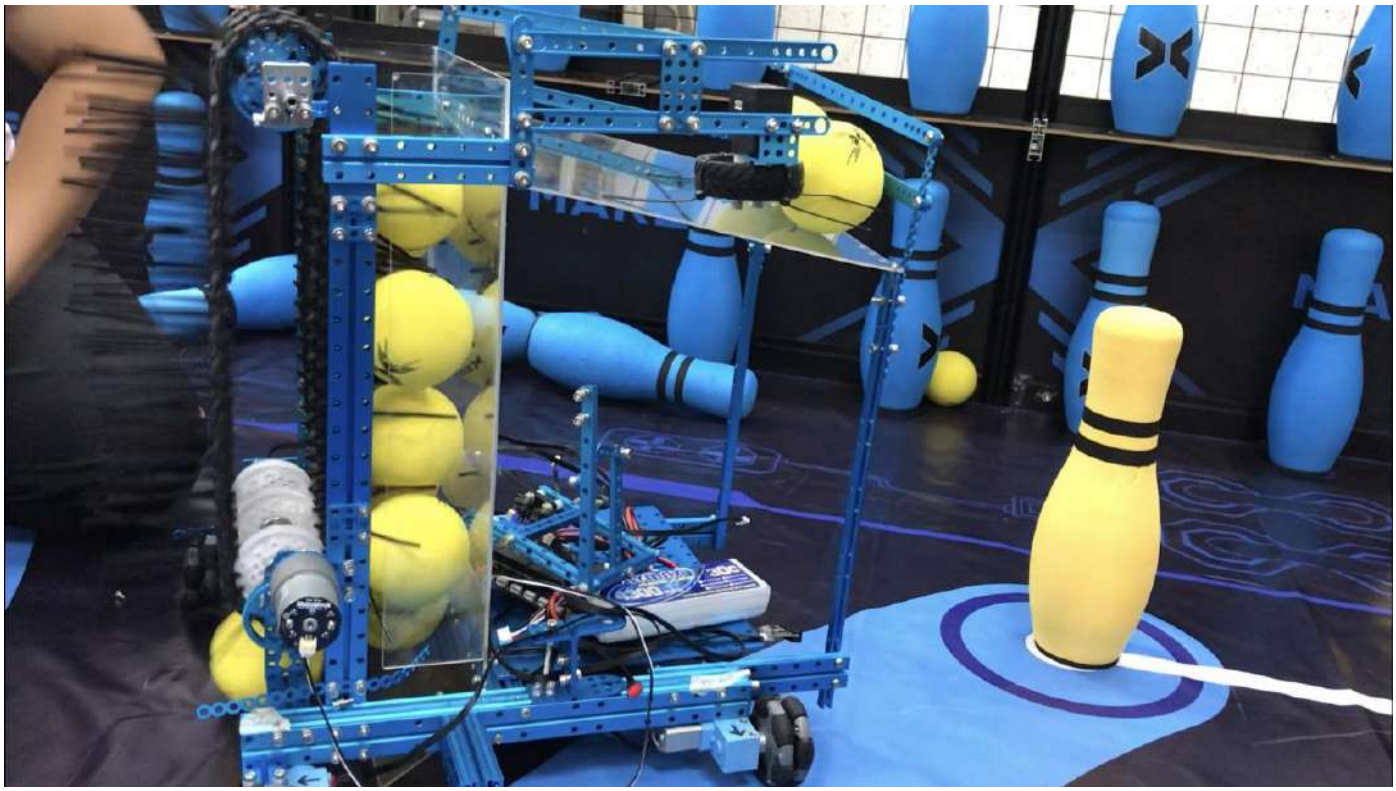
Hardware



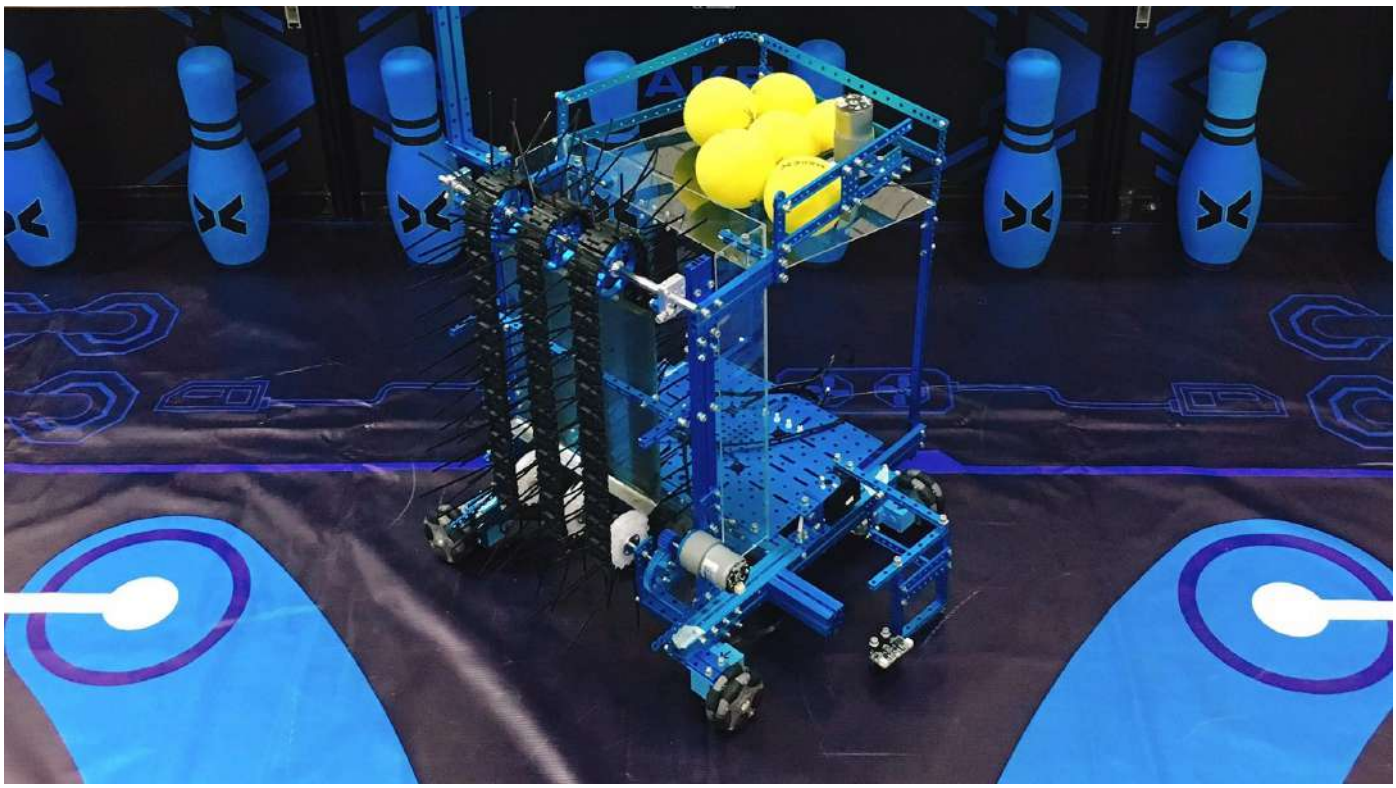


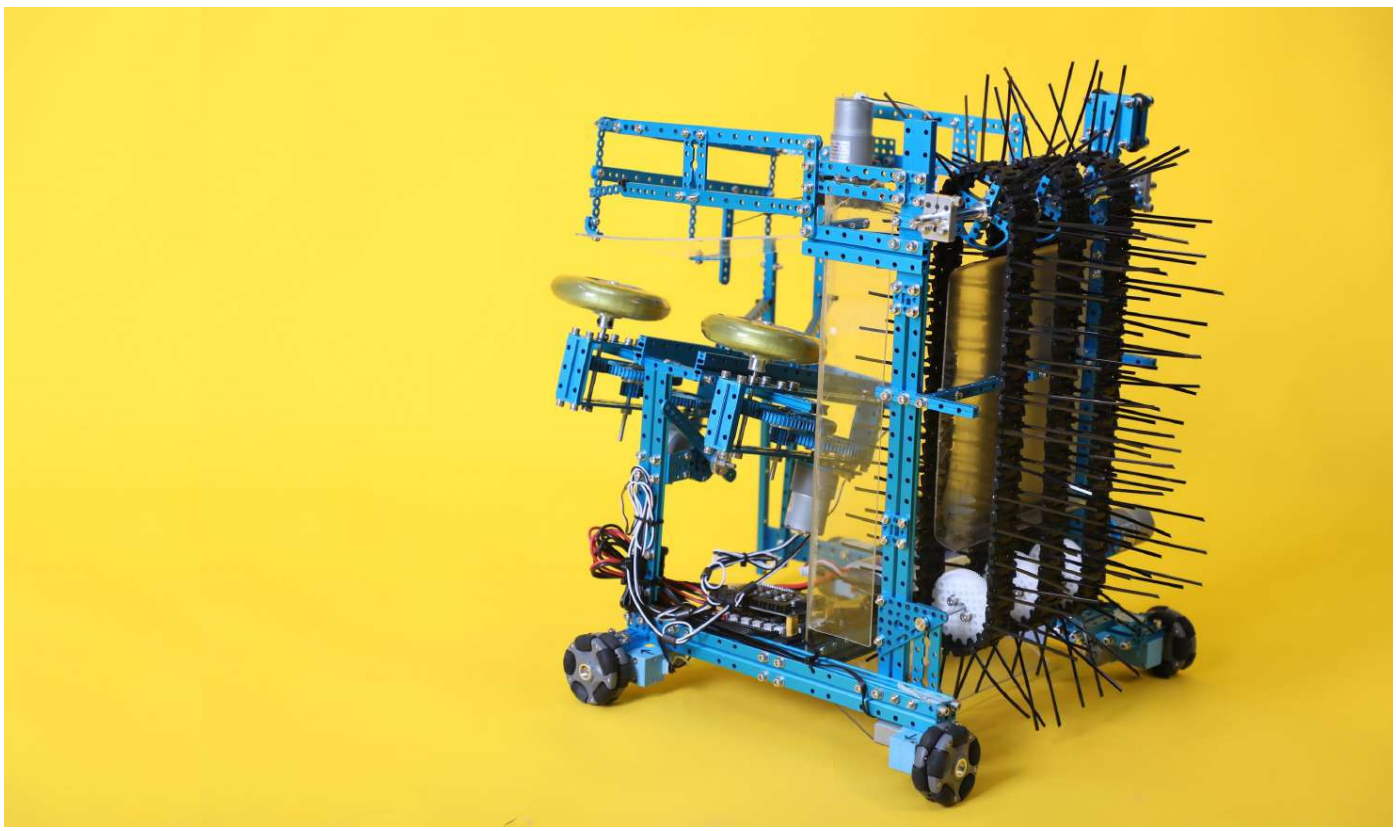
Hardware



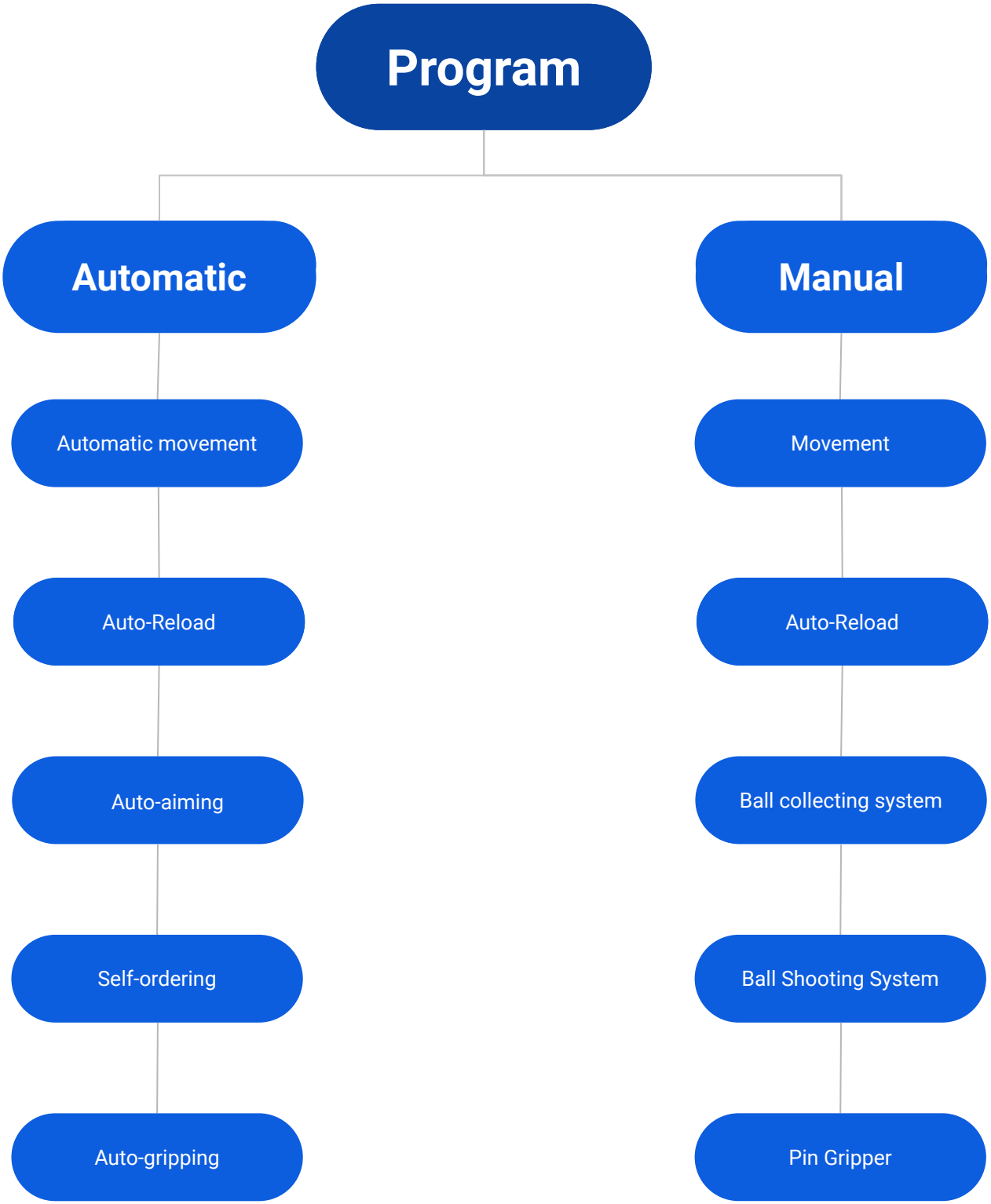


Hardware

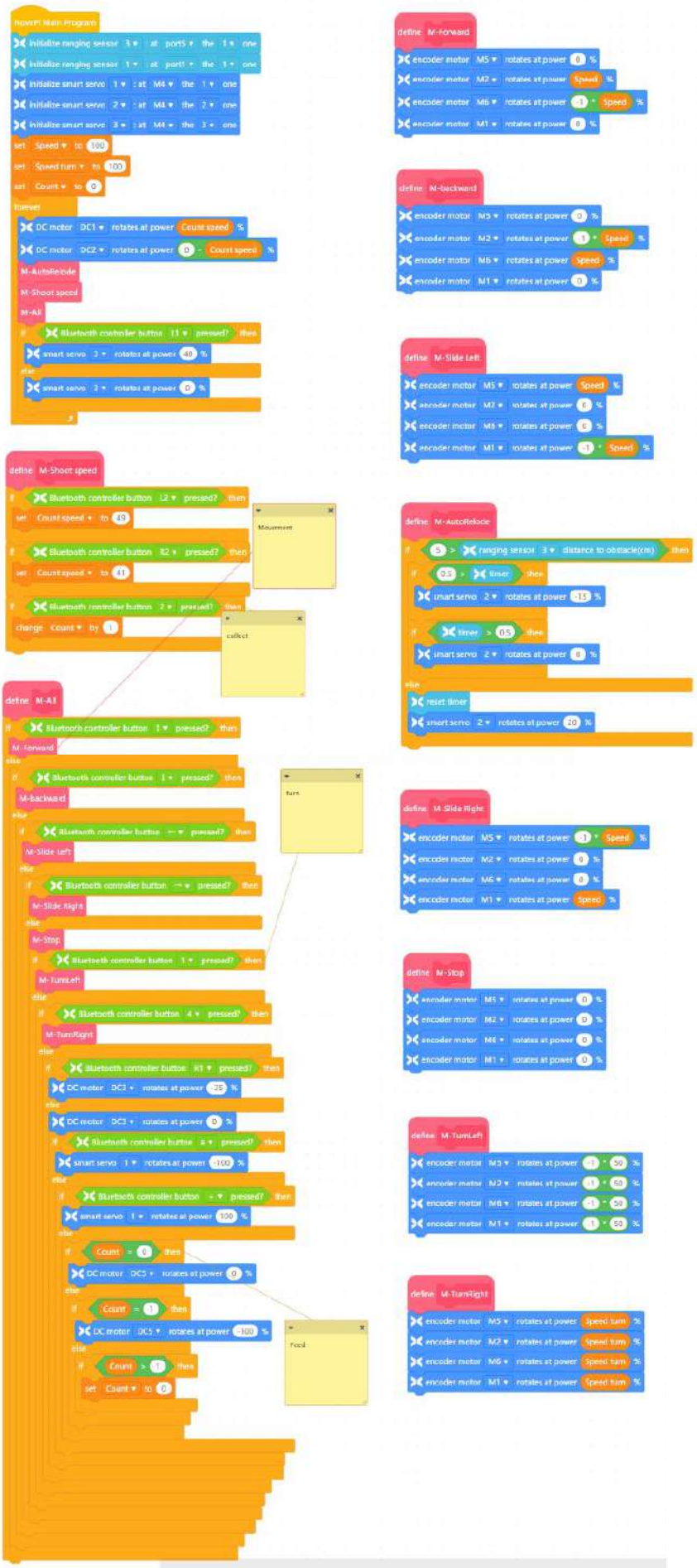




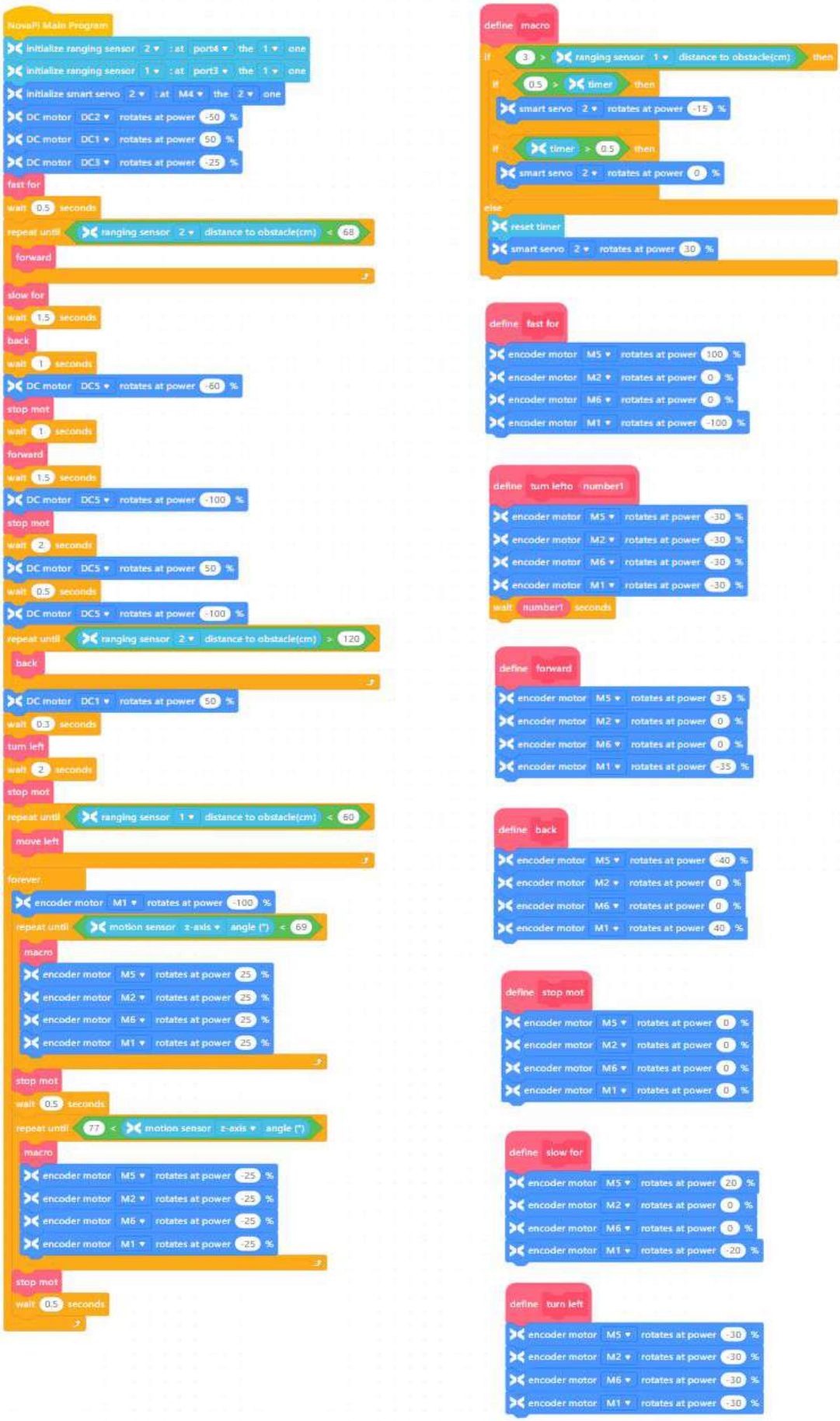
Software


Program
Automatic
Automatic movement
Auto-Reload
Auto-aiming
Self-ordering
Auto-gripping
Manual
Movement
Auto-Reload
Ball collecting system
Ball Shooting System
Pin Gripper

Manual Program



Automatic Program



Problem solutions

Drive System

The wheel get slanted

What causes problem

- We added too many unnecessary parts to the robot which makes the robot too heavy. Also, the front weight and rear weight of the robot is not balanced make it hard to control.
- At first, we chose to use the holonomic drive system because it is the drive system that allows the robot to travel in all 8 directions. But due to the facts that the robot is heavy and the wheel holder is not so strong, it make the wheel holder slanted or bent. When the wheel holder bent, the robot can't turn precisely and move smoothly.

How we solve the problems

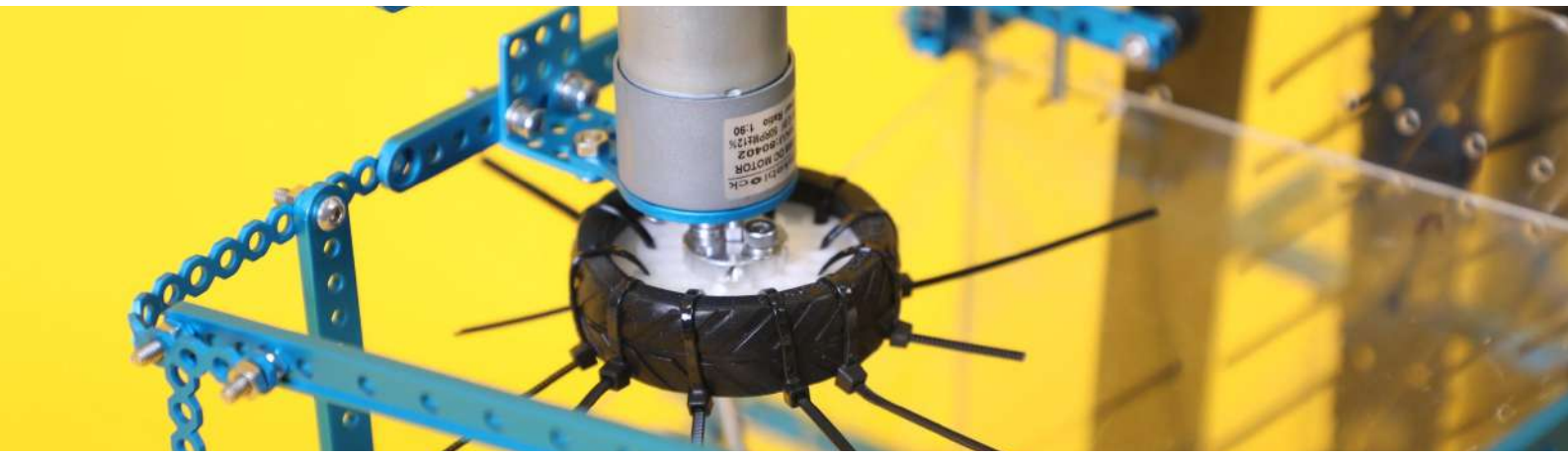
- We redesigned the robot, removed all the unnecessary parts which makes the robot lighter.
- We change form holonomic drive system to four wheel tank drive with two wheel horizontal and two wheel vertical, the new drive system is stronger and more stable. It can also travel faster, smoother and turn more precisely. We designed the best position for placing each part so the front and rear side of the robots are balanced which makes it easier to control.

Ammunition Feeder

No space for ammunition tank

What causes problem

- When we redesigned the ball collecting machine, at first, we placed the conveyor belts on both side of the robot. Since the size of the robot is determined, both side of the robot can't exceed 50 cm (cable tie count). There isn't not enough space for ball storing tank.



How we solve the problems

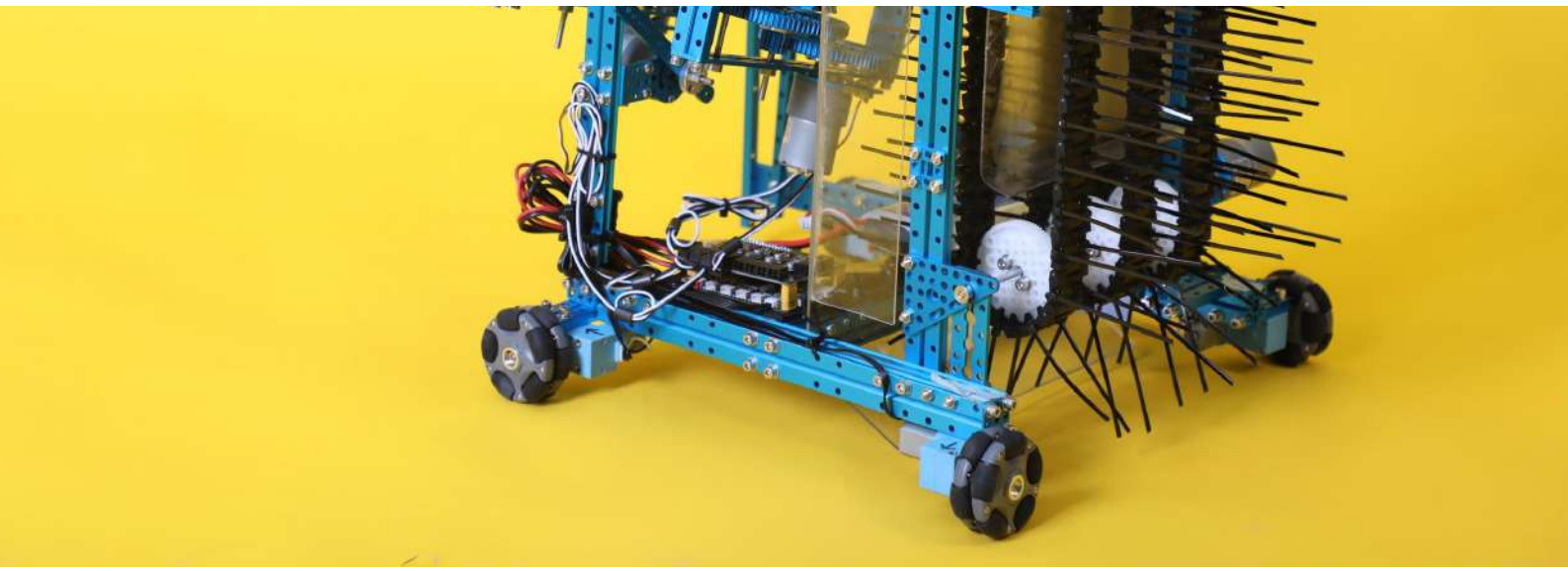
- We removed one side of the ball collecting machine and replaced it with the ball storing tank. We measured how much space is left and cut the acrylic sheet in the size that is able to fit into the space left. We attached it slightly tilted so that all the ball will gather in one spot. Later we added barriers to contain the ball and left one corner an opening to let down the ball.

Ammunition Collector

Balls stuck with conveyor belt

What causes problem

- There were too much gap between each conveyor belts then balls could fell inside the space which caused the conveyor belts slipped out from the gear.



How we solve the problems

- We rearranged the conveyors space. Make it closer to each other so there were no big gap for the balls to get in.

Software

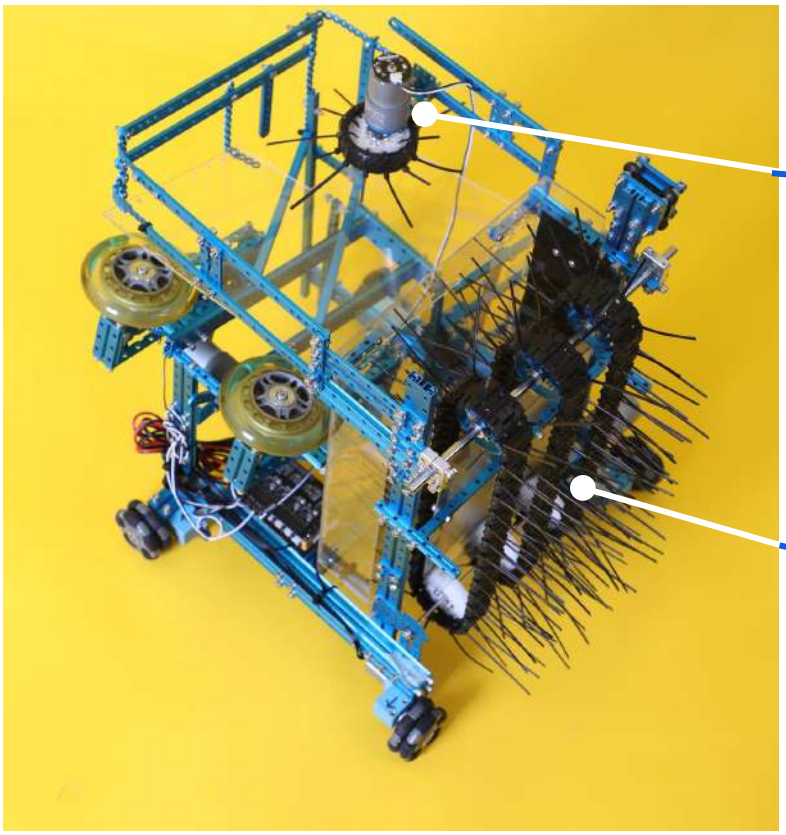
Mblock program problems

- It was hard to write a program for a robot to be fast enough, it was inconsistent
- RGB sensor has issues, sometimes it would read the wrong values for each color
- Ranging sensor sometimes had delays so it wasn't too accurate.

- We use sensors to make it more consistent but the sensors weren't that accurate.
- We ended up not using color sensors, it still wasn't accurate.

Project Summary

Project Structure



Ball feeding machine

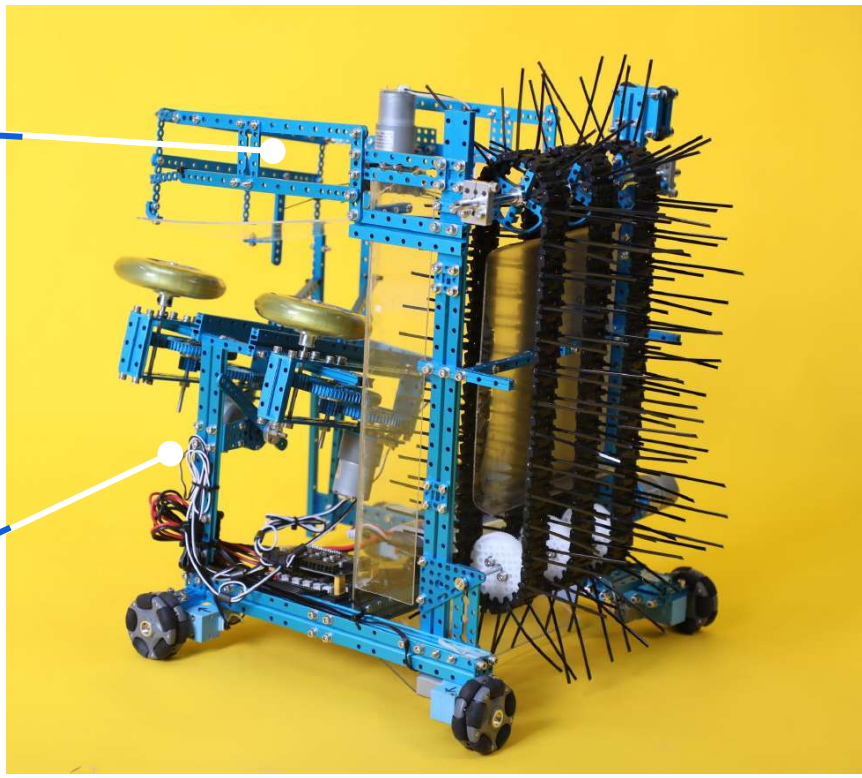
-Powered by smart servo and coordinate with ranging sensor to activate the rotation of the wheel when the ball is not loaded in the shooting chamber

Ball collecting machine

- Consisted of 3 conveyor belts
- Powered by 37mm 50 rpm DC motor

Ball shooting machine

- Powered by 37mm 200 rpm DC motor
- 2 rollerblade wheels and 2 gear boxes



Drive system

- Consisted of 4 omni wheels
- 5 Smart 180 encoder motor

Efforts - improvements

Software

In terms of software, we had problems with the motors at first, we tried to use delay in seconds however that didn't work out very well. So we decided to switch over to rob sensors, the problem with this one is that the rub sensor wasn't accurate and it wasn't picking up the correct values. Lastly we switched over to ranging sensors, they were the most accurate out of the bunch. So at last while programming we used mainly ranging sensors and not much of motor delaying.

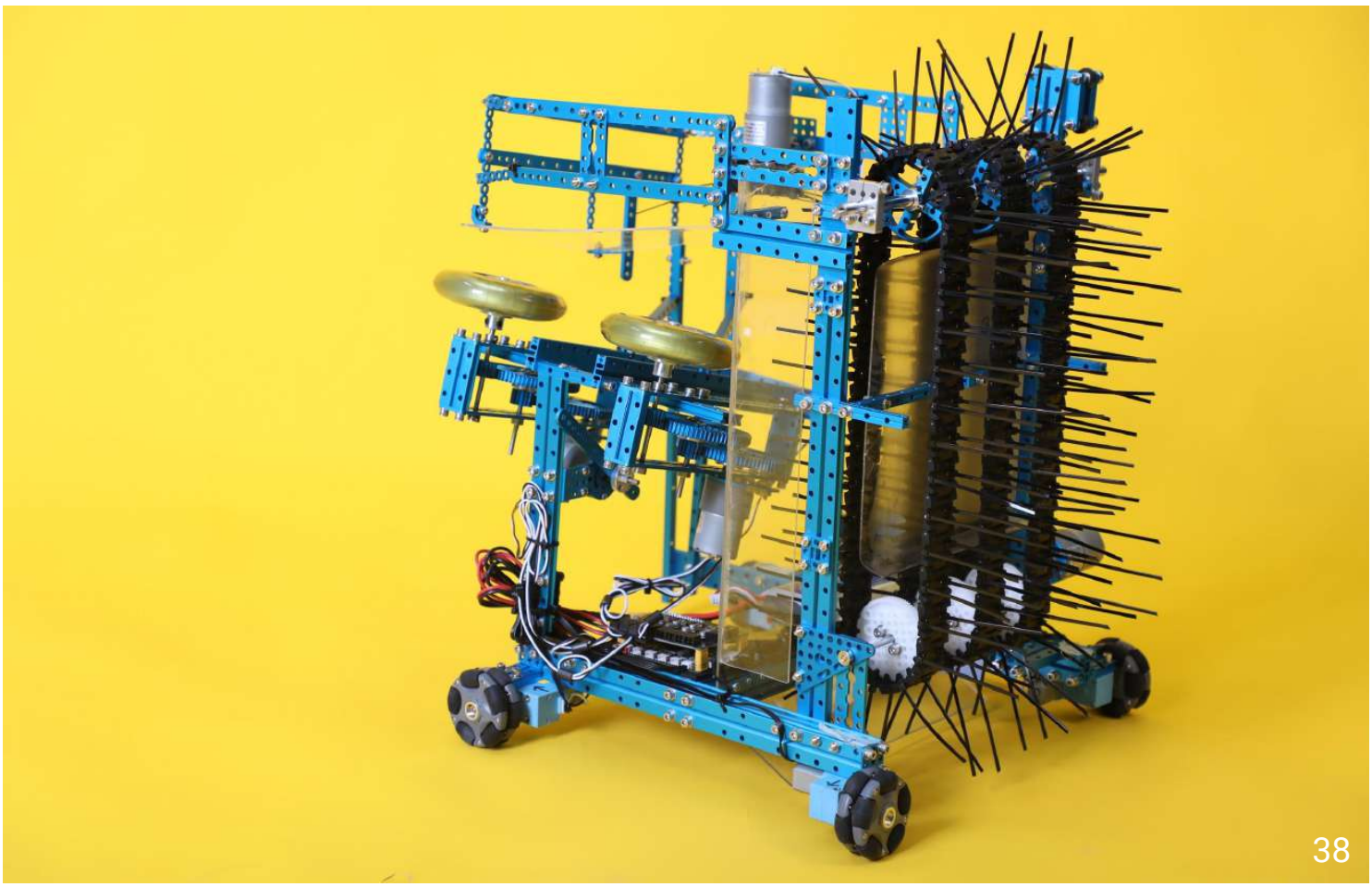
Hardware

For hardware, at first we used the holonomic drive system which can travel in all 8 directions, it was working fine and well at first, however as the work continues the robot got a lot heavier and larger causing the wheels so be slanted. So we switched out the drive system to a better one with 2 wheels lying horizontally and the other 2 lying vertically, we noticed that this solution made the movement of the robot smoother. We spend many day trying to fix the problem that the ball stuck in the conveyor belt. We try many way to fix the problem, we add more barrier, we change the gear raton and the motor speed, we add more conveyer belt, and at last, it can finally collect many ball at the same time. We also spend a lot of effort on building the best ball shooting machine possible, we try our best to make it shoot as hard as possible. In the end, the ball shooting machine can shoot so hard that we need to decrease the speed in half in the program.

Function and structure

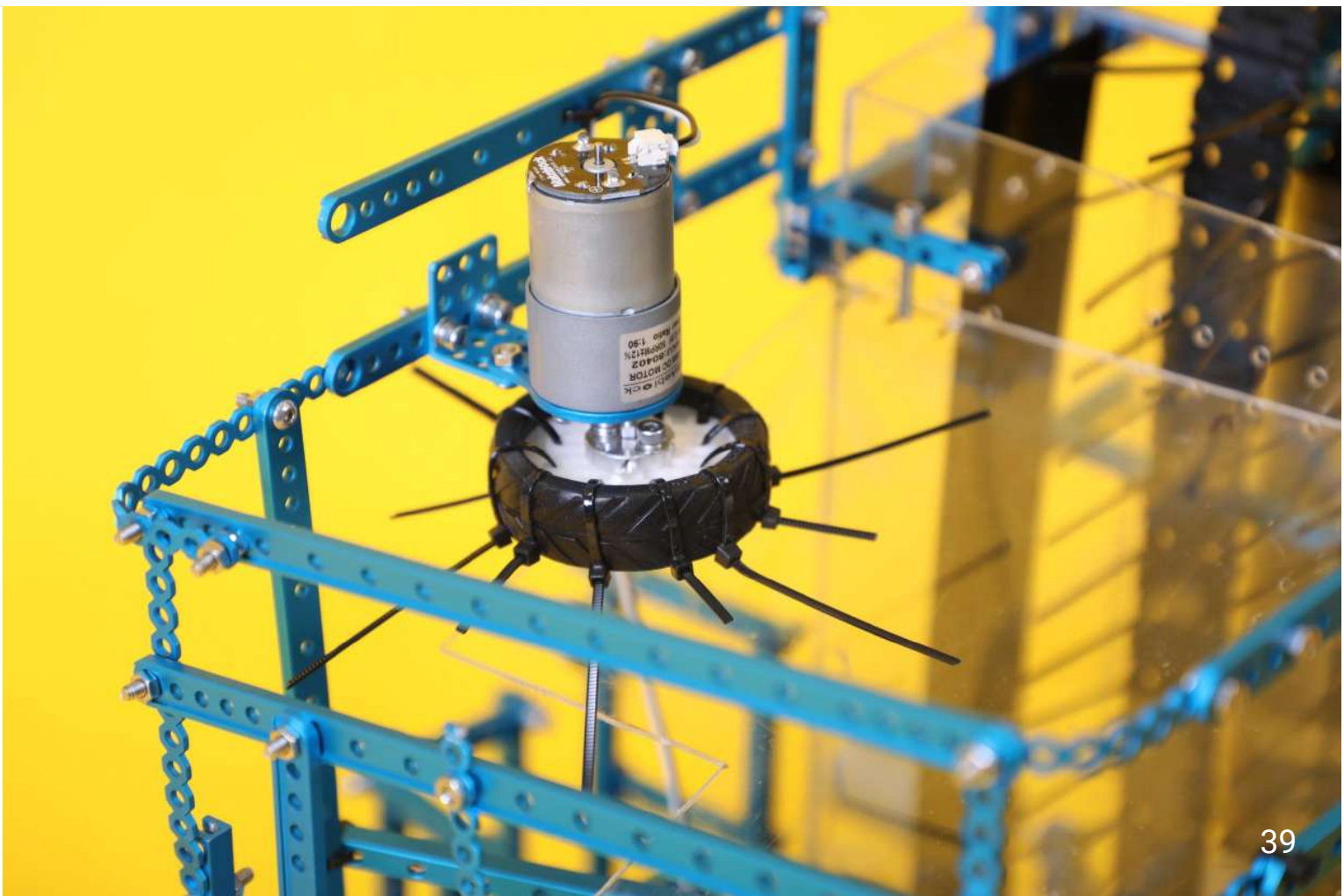
Function

In the end, the robot was able to function quite well in both manual and automatic stage, in the manual stage we made sure that the robot was fast enough to knock some pins down on the enemy alliance, and on the automatic program we made it so that the robot has a high chance to be able to either shoot or move the pin to the safe zone. Overall, the robot is able to function very well and hopefully able to score us some points.



Technical innovations

- When we made the reloading system for the robot, we noticed that the system had issues such as balls jamming. So we decided to make an automated reloading system which uses a ranging sensor to detect and sent command to the board to decide whether it should spin or stop spinning.
- When we program the auto reload system, we use hardware delay to prevent the ranging sensor for detecting the ball that just go pass the sensor
- Instead of putting the ball storing tank on the bottom of the robot, we put it on the top of the robot and use the ball feeding machine to make the ball flow down to the ball shooting machine.



Competition strategy

scoring and defense

In terms of scoring, during the automatic stage if our robot is designated on the right side of the alliance we will collect the yellow pin to the safe area, however in the left side we will try to knock the other team's pins down. During manual stage we will try our best to hit the pins on the enemy alliance. After the modification we will be able to gain defense by our net that we built. We could either keep shooting or defend our own pins, this strategy could be used by both alliances.

Team Biography

Tonnum

Jirapatra Prasert

- 13 years old
- 8th-Grade, studying in King Mongkut's International Demonstration School, Thailand

Mee-Pooh

Phonlakrit Tiraratn

- 13 years old
- 8th-Grade, studying in King Mongkut's International Demonstration School, Thailand

Joe

Tanakorn Sawetawan

- 13 years old
- 8th-Grade, studying in King Mongkut's International Demonstration School, Thailand

Mentor

Nu

Taweesak Khangsri

- 21 years old
- 3rd-year, studying in Engineering department
- King Mongkut Institute of Technology Ladkrabang University, Thailand

Park

Kunanon Phattaravatin

- 21 years old
- 3rd-year, studying in Engineering department
- King Mongkut Institute of Technology Ladkrabang University, Thailand

Team Culture

"NEVER STOP TO LEARN AND IMPROVE"

TEAM
KMIDS THAILAND

TEAM
KMIDS THAILAND

COACH

This team has 3 coaches whose name are Mr. Thaweesak Khansri, Mrs. Siriwon Jumneanla, and Mr. Kunanon Phattaravatin. Currently, they are 3rd years students in Engineering at KMITL (King Mongkut Institute of Technology Ladkrabang), Bangkok Thailand

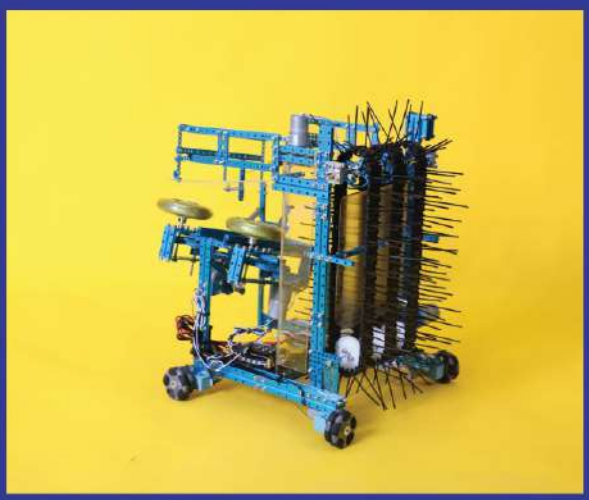
TEAM MEMBER

JIRAPATRA PRASERT

PHONLAKRIT TIRARATN

TANAKORN SAWETAWAN

They are studying in the same class in grade 7 at KMIDS (King Mongkut International Demonstration School). They are currently 13 years old individually.



Story Sharing

Previous competitions

Last year, our team consisting of 3 people: Joe, Meepooh, Tonnum participated in the WRO 2018 competition open category (World Robot Olympiad 2018) and got 1st place in the national competition in Thailand and 15th place in the international one. We got many experiences from that competition which we will also apply to this competition as well.

Class arrangements

Surprisingly, while doing this competition we were also in the same class for grade 7, however in grade 8 we were split. This helped us to be able to communicate with each other with ease and have better connection with each other.

Make block experience

While Tonnum who has touched the make block platform many times and is used to the platform. This is Joe's and Mee Pooh's first time using this platform. Surprisingly, Joe and Mee-Pooh can adapted and does a lot in this project. Joe did the entire automatic stage program and Mee-Pooh built the robot hardware and work on the manual stage program. This is also one interesting fact about this team.

Growth and suggestions

Growth during competition

No doubt, in this competition we also gain many things in terms of our growth. For example, is that we were able to interact with our friends during the term break and have a stronger connection with each other. We also gain knowledge and experience from this competition to improve our programming, and building skills when it comes to robotics. Surely we were able to gain many things in this competition.

Suggestions for competition

We suggest that the makeX competition improves the quality of the sensors(ranging and RGB) to make them more accurate and precise. This could help everyone make their programs more simple and save a lot of time. We also suggest that makeblock should created a special motor only use in the MakeX competition with higher torque and can spin faster, And also special servo motor to be stronger.

KMIDS Thailand

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